Mathematics Standards Rationale

The four National Council of Teachers of Mathematics (NCTM) standards of problem solving, reasoning, communication and connections are goals interwoven throughout the Arizona mathematics standards. These goals are the reason people study and use mathematics, and they should permeate everything we do in and outside the classroom.

Whenever possible, mathematical learning should be placed in a broader, problem solving context and evaluated through performance assessments. In this setting, students discover questions involving numbers or equations from a real-world context which lead to answers that have meaning. Ultimately, all problems should be application problems; more ideally, problems should be presented in the broader context of an investigation or project. This way the students use problem solving, reasoning, communication and connections in every mathematical activity. The spirit of these four goals is a mathematical apprenticeship in which the students solve problems on a daily basis, much as mathematics is used in the real world.

Even the youngest students can use mathematics to solve social science problems, engineering problems and business problems in a meaningful way. As early as possible, students should learn that mathematics is everywhere in the world around them. They should realize that in the real world not all answers are small whole numbers; instead they can be large or small and/or have a fractional part.

As students develop their ability to perceive and conceptualize in problem solving, they should reason about the mathematics they do. Teachers should guide students to ask such questions as: *Does the answer make sense? Are there other ways to arrive at the answer? Does the answer bring up more questions? Can I answer those? What other information would I need?* It is this kind of reasoning that enriches a mathematical educational experience. If students do answer such significant questions, they then naturally apply mathematics in everyday life. Without this guidance, they remain mathematically deficient.

Teachers should engage students in mathematical discourse at all stages of learning. Mathematics was developed as a means to communicate about quantities, logical relationships and unknowns. To use this language, students should communicate (both orally and in writing) everything they do mathematically. They should explain their mathematical thinking through language, through models, graphically, geometrically, numerically and algebraically. Students should be encouraged to express themselves in as many ways as possible and to learn to translate between one mathematical language and another.

Students should regularly see the mathematical connections within the course of an investigation or project. They must experience mathematics primarily through its connections to other disciplines. For too long we have structured our curricula to reach the few who will use mathematics in isolation rather than the majority who will apply it to their work or study in other fields.

A variety of tools should be available to students as they develop concepts and understandings of mathematics. Graphing calculators and computers should be standard equipment in mathematics classrooms. New technology not only has made calculations and graphing easier, it has changed the very nature of the problems important to mathematics and the methods mathematicians use to investigate them.

As the four essential standards–problem solving, reasoning, communication and connections–and the implementation of technology become functioning parts of our curricula, we can expect all Arizona students will develop the mathematical power to confidently handle the future. They will be able to face the world knowing that they can not only merely compute but also that they can use meaningful mathematics to solve real problems.

The organization of the content in these standards is designed for readability purposes and is not intended to dictate sequence or to define the structure of courses. Topics from all six mathematics standards need to be continuously integrated within the curricula.

Table 1. Mathematics Standards

STANDARD 1: **Number Sense**

Students develop number sense and use numbers and number relationships to acquire basic facts, to solve a wide variety of real-world problems, and to determine the reasonableness of results.

STANDARD 2: **Data Analysis and Probability**

Students use data collection and analysis, statistics, and probability to make valid inferences, decisions and arguments and to solve a variety of real-world problems.

STANDARD 3: **Patterns, Algebra and Functions**

Students use algebraic methods to explore, model and describe patterns, relationships and functions involving numbers, shapes, data and graphs within a variety of real-world problem solving situations.

STANDARD 4: **Geometry**

Students use geometric methods, properties and relationships as a means to recognize, draw, describe, connect and analyze shapes and representations in the physical world.

STANDARD 5: **Measurement and Discrete Mathematics**

Students make and use direct and indirect measurement, metric and U.S. customary, to describe and compare the real world and to prepare for the study of discrete functions, fractals and chaos which have evolved out of the age of technology.

STANDARD 6: **Mathematical Structure/Logic**

Students use both inductive and deductive reasoning as they make conjectures and test the validity of arguments.

MATHEMATICS STANDARDS
BY LEVEL: FOUNDATIONS (Grades 1-3)

Throughout all of the following six standards, students will use reasoning, communication skills, and appropriate manipulatives (concrete materials) and technology within real-world problem-solving situations to make connections within mathematics and between mathematics and other disciplines.

STANDARD 1: NUMBER SENSE

Students develop number sense and use numbers and number relationships to acquire basic facts, to solve a wide variety of real-world problems, and to determine the reasonableness of results.

- **1M-F1. Represent and use numbers in equivalent forms through the use of physical models, drawings, word names and symbols (e.g., using concrete materials and fraction equivalents to represent and compare halves, thirds, fourths, eighths and tenths)**

  PO 1. Make a model to represent a given whole number
  PO 2. Identify a whole number represented by a model with a word name and symbol
  PO 3. Construct equivalent forms of whole numbers (e.g., 15 + 5 = 10 + 10)
  PO 4. Make a model to represent a given fraction (e.g., geometric model–shading a picture, set model–part of an egg carton) (halves, thirds and fourths)
  PO 5. Identify the fraction represented by a model with a word name and symbol (halves, thirds and fourths)
  PO 6. Identify a given model that is divided into equal fractional parts (halves, thirds and fourths)

- **1M-F2. Relate counting, grouping and place-value concepts to whole numbers (e.g., reading and writing the number represented when objects are grouped by thousands, hundreds, tens and ones)**

  PO 1. Read whole numbers up to one thousand
  PO 2. Write whole numbers up to one thousand
  PO 3. Order whole numbers (e.g., smallest to largest, largest to smallest) up to one thousand
  PO 4. Construct a model to represent place value concepts
  PO 5. Write a whole number in expanded notation (e.g., 531 = 500 + 30 + 1)
  PO 6. Read aloud a whole number with correct place value words (e.g., a student will read 5 2 1 as “five hundred twenty-one”)
  PO 7. Count money to $5.00 using bills and coins

- **1M-F3. Understand the meaning for and application of the operations of addition, subtraction, multiplication and division**

  PO 1. Demonstrate with models to show the process used in addition (joins things together, increases)
  PO 2. Demonstrate with models to show the process used in subtraction (takes away, compares, finds the difference, decreases)
  PO 3. Demonstrate with models to show the process used in multiplication (uses repeated addition, counts by multiples, combines things that come in groups of equal size, makes arrays, uses area models)
  PO 4. Demonstrate with models to show the process used in division (puts things into groups of equal size, shares equally, uses repeated subtraction)
  PO 5. Demonstrate with models the operations of addition and subtraction up to two three-digit whole numbers
  PO 6. Select appropriate operations to solve word problems
  PO 7. Solve word problems using the appropriate operations
  PO 8. Apply mathematical operations in everyday situations

- **1M-F4. Demonstrate proficiency with the operations of addition and subtraction of whole numbers**

  Note: Proficiency-–accurate and consistent solving of computational problems in a reasonable time, using self checking skills

  PO 1. Demonstrate proficiency with basic facts up to 20
  PO 2. Add and subtract two three-digit whole numbers
  PO 3. Solve problems using a variety of mental computations and estimation

- **1M-F5. Demonstrate proficiency with the operations of multiplication and division of single-digit numbers**

  PO 1. Demonstrate proficiency with basic facts up to the fives
  PO 2. Solve problems using a variety of mental computations and estimation

- **1M-F6. Add and subtract commonly used fractions and decimals**

  PO 1. Demonstrate with models addition and subtraction of fractions with common denominators (halves, thirds and fourths)
  PO 2. Add and subtract money up to $5.00

- **1M-F7. Select and use appropriate techniques to facilitate computation (e.g., mental, estimation, paper-and-pencil, calculator and computer methods) while solving problems and determining the reasonableness of results**

  PO 1. Select a computational technique to solve a problem
  PO 2. Solve a problem using the appropriate computational techniques
  PO 3. Evaluate the reasonableness of results using a variety of mental computation and estimation techniques (e.g., compatible numbers, front-end, chunking)
  PO 4. Use technology (e.g., calculators, computers, multimedia) to solve problems containing larger numbers

STANDARD 2: DATA ANALYSIS AND PROBABILITY

Students use data collection and analysis, statistics, and probability to make valid inferences, decisions and arguments and to solve a variety of real-world problems.

- **2M-F1. Collect and analyze data using the concepts of largest, smallest, most often, least often and middle**

  PO 1. Collect and record data from surveys (e.g., favorite color or food, height, ages) or experiments
  PO 2. Organize (e.g., sorting, sequencing, tallying) information from surveys or experiments
  PO 3. Identify largest, smallest, most often recorded (i.e., mode), least often and middle (i.e., median) using sorted data
  PO 4. Formulate questions from organized data

- **2M-F2. Construct, read and interpret displays of data to make valid decisions, inferences and predictions**

  PO 1. Make and label a graph (horizontal bar, vertical bar, picture graph or tally chart) from organized data
  PO 2. Answer questions about a circle graph (i.e., pie graph) divided into halves and fourths
  PO 3. Answer questions about a pictograph where each symbol represents multiple units
  PO 4. Write a title representing the main idea of a graph
  PO 5. Locate points on a line graph (grid) using ordered pairs
  PO 6. Draw conclusions (e.g., valid decisions, conjectures and predictions) from graphed data
  PO 7. Formulate questions from graphs, charts and tables
  PO 8. Solve problems using graphs, charts and tables (e.g., given a bar graph or preferred flavors of ice cream, students have to decide what flavors of ice cream to order)

- **2M-F3. Predict and measure the likelihood of events and recognize that the results of an experiment may not match predicted outcomes**

  Note: Probability experiments are simple one-step activities, e.g., tossing a two-colored counter

  PO 1. Collect and record data from a probability experiment
  PO 2. Organize (e.g., sorting, sequencing, tallying) data from a probability experiment
  PO 3. Name the possible outcomes of the probability experiment
  PO 4. Predict the most likely or least likely outcome in probability experiments
  PO 5. Compare the outcome of the experiment to the predictions

- **2M-F4. Understand the concept of sample (i.e., that a larger sample of observed outcomes leads to more reliable information)**

  PO 1. Compare data from probability experiments in which the experiments are performed a different number of times with the given expected outcomes (e.g., toss a two-colored counter 10 times and record the data; toss the counter 20 times and record the data; compare the results to the expected outcome [1 out of 2])

STANDARD 3: PATTERNS, ALGEBRA AND FUNCTIONS

Students use algebraic methods to explore, model and describe patterns, relationships and functions involving numbers, shapes, data and graphs within a variety of real-world problem-solving situations.

- **3M-F1. Create, describe and extend a variety of patterns using shapes, events, designs and numbers**

  Note: Types of patterns: manipulatives, symbols, words, numbers and pictures

  PO 1. Create a pattern using a model (e.g., symbolically: numbers or letters; visually: shapes, designs, numbers or pictures; auditorially: clapping, singing or listening: and kinesthetically: dancing, movement or tactile)
  PO 2. Communicate orally or in written form the repetition of objects in a pattern
  PO 3. Communicate orally or in written form a given pattern occurring in a sequence of numbers (e.g., counting by 10's, 5's, 3's, 2's, odd, even, forward and backward)
  PO 4. Extend patterns using a model
  PO 5. Extend a given pattern occurring in a sequence of numbers

- **3M-F2. Formulate generalizations about patterns (e.g., color, shape, size, direction, orientation) to make predictions**

  PO 1. Make predictions based on a given pattern

- **3M-F3. Represent and describe how changing the value of one variable results in a change in another**

  PO 1. Describe in a given situation how a change in one variable results in the change of another (e.g., if you have to share a batch of cookies with friends, the more friends you have, the fewer cookies you'll each get)

- **3M-F4. Represent and describe mathematical relationships such as order, grouping, etc. (e.g., given a string of numbers, describe the pattern, define the relationship between the numbers and determine the next number in line)**

  PO 1. Identify the pattern in skip counting
  PO 2. Determine the next number in a skip counting pattern

- **3M-F5. Recognize the symbols of equality and inequality**

  PO 1. Use the symbols <, >, = to compare whole numbers

- **3M-F6. Find missing elements in number sentences**

  PO 1. Find the missing number in addition and subtraction number sentences

STANDARD 4: GEOMETRY

Students use geometric methods, properties and relationships as a means to recognize, draw, describe, connect, and analyze shapes and representations in the physical world.

- **4M-F1. Relate geometric concepts to number and measurement ideas (e.g., dividing a rectangle into parts to represent multiplication)**

  Note: Two-dimensional shapes: square, rectangle, triangle, circle
  Three-dimensional figures: sphere, cube, rectangular prism (box),cone, pyramid
  Attributes: size; shape; the number of sides, corners and faces

  PO 1. Identify two-dimensional shapes by name and attribute
  PO 2. Draw two-dimensional shapes
  PO 3. Identify three-dimensional figures by name and/or attribute
  PO 4. Compare attributes of two-dimensional shapes
  PO 5. Compare attributes of three-dimensional figures
  PO 6. Use a rectangular array to represent a multiplication fact (e.g., put 12 tiles in a rectangular array; make a 3 x 4, 6 x 2, and 12 x 1 array)

- **4M-F2. Predict how shapes can be changed by combining or dividing them**

  PO 1. Build geometric shapes with other common shapes (e.g., tangrams, pattern blocks, geoboards)

STANDARD 5: MEASUREMENT AND DISCRETE MATHEMATICS

Students make and use direct and indirect measurement, metric and U.S. customary, to describe and compare the real world and to prepare for the study of discrete functions, fractals and chaos which have evolved out of the age of technology.

- **5M-F1. Demonstrate that a single object has different attributes that can be measured in different ways (e.g., length, mass/weight, time, temperature, area and volume)**

  PO 1. Determine the characteristics (attributes) of an object that are measurable (e.g., length and weight are measurable; color and texture are not measurable)
  PO 2. Identify the type of measure (e.g., weight, height, volume) for each attribute

- **5M-F2. Explain the concepts related to units of measure and demonstrate the process of measurement with non-standard (e.g., using paper clip lengths), U.S. customary and metric units**

  PO 1. Select the appropriate unit of measure for a given characteristic of an object

length -	inches, feet and yards; centimeters and meters
capacity/volume -	cups, gallons and liters
mass/weight -	ounces, pounds, grams and kilograms

  PO 2. Select the appropriate tool (e.g., ruler, thermometer, measuring cup, scale) to measure the given characteristic of an object
  PO 3. Measure a given characteristic of an object using non-standard units of measure
  PO 4. Measure a given characteristic of an object using standard units of measure
  PO 5. Tell time to the nearest minute on digital and traditional (analog) clocks
  PO 6. Determine the passage of time (i.e., units of days, months and years) using a calendar

PO 7. Compare units of measure to determine *more* or *less* relationships

length -	inches and feet
	feet and yards
	centimeters and meters
capacity -	cups and gallons
mass -	ounces and pounds
	grams and kilograms
time -	minutes and hours
	hours and days
	days and weeks
	months and years
money -	pennies, nickels, dimes,
	quarters and dollars

PO 8. Compare units of measure to determine equivalent relationships

length -	inches to feet
time -	minutes to hours
	days to weeks
	months to years
money -	pennies, nickels, dimes,
	quarters to dollars

PO 9. Read a thermometer in Celsius and Fahrenheit to the nearest degree

- **5M-F3. Make estimates of measurement**

PO 1. Estimate a measurement
PO 2. Compare the estimation to actual measure
PO 3. Evaluate the reasonableness of the estimation

- **5M-F4. Use discrete mathematical models for graphs to represent everyday situations (e.g., determine how many ways to move from point A to point B on a grid)**

PO 1. Make a diagram to represent the number of combinations between two sets (e.g., "How many outfits can one make with three different colors of shirts and two different pairs of pants?")

STANDARD 6: MATHEMATICAL STRUCTURE/LOGIC

Students use both inductive and deductive reasoning as they make conjectures and test the validity of arguments.

- **6M-F1. Recognize that numbers are used for different purposes in the world and a variety of mathematical notations represent these situations**

  PO 1. Formulate mathematical problems from everyday situations

- **6M-F2. Draw inductive and deductive conclusions about mathematics**

  PO 1. Extend a pattern using inductive reasoning (e.g., "What is the next number after 2, 4, 6, 8?")
  PO 2. Make a prediction based on existing information (e.g., "All the students in a 3rd grade class are under 10 years old. How old will the next new student probably be?")

- **6M-F3. Distinguish between relevant and irrelevant information**

  PO 1. Select the information necessary to solve a given problem

- **6M-F4. Interpret statements made with precise language of logic (e.g., *all, every, none, some, or, many*)**

  PO 1. Use words such as *all*, *every*, *none*, *some* and *many* to make reasonable conclusions about situations

MATHEMATICS GLOSSARY

Absolute Value A number's distance from zero on a number line. The absolute value of –4 is 4; the absolute value of 4 is 4.

Algebraic Methods The use of symbols to represent quantities and signs to represent their relationships.

Algebraic Sentence A general term for equations and inequalities.

Algorithms A mechanical procedure for performing a given calculation or solving a problem through step-by step procedures such as those used in long division.

Angle Measure The measure of the space between two lines that meet in a point. Angles are measured in degrees or radians.

Axiomatic Systems Systems that include self-evident truths; truths without proof and from which further statements, or theorems, can be derived.

Binomial In algebra, an expression consisting of two terms connected by a plus or minus sign, such as $4a + 6$.

Box-and-Whisker Plot A graphic method for showing a summary of data using median, quartiles and extremes of data. A box plot shows where the data are spread out and where they are concentrated.

Census The count of a population.

Combinations Subsets of a larger number of items (e.g., the number of different teams of three that can be chosen from a group of 21).

Computational Techniques Operations or tools–number lines, calculators.

Complex Numbers Numbers that have the form $a + bi$ where a and b are real numbers and i is an imaginary number.

Congruence The state of having the same size and shape.

Conjecture An inference drawn from observed patterns in several examples.

Contextual Situation Relating mathematical problems to real, modeled or illustrated circumstance.

Coordinate System Any set of two or more magnitudes used to locate points, lines or curves. Commonly placed by using a horizontal axis (x-axis) and vertical axis (y-axis).

Correlation Coefficient A statistical measure that relates how well a set of data points can be modeled by a line.

Cosine The trigonometric function that is defined as the ratio of the leg adjacent to an angle to the hypotenuse of its right triangle.

Counterexample An example of a conditional statement in which the hypothesis is true and the conclusion is false.

Curve Fitting Plotting data and observing the pattern to predict trends.

Deductive Reasoning A series of logical steps in which a conclusion is drawn directly from a set of statements that are known or assumed to be true.

Dilation A transformation that either enlarges or reduces a geometric figure proportionately.

Direct Proof A conclusion proved through deductive reasoning.

Discrete Math The study of mathematical properties of sets and systems that have only a specific number of elements. For example, the results of tossing dice form a discrete set of events, since a die has to land on one of its six faces.

Empirical Relating to the collection of actual data.

Equation A mathematical statement in which one expression is equal to another.

Euclidean Transformations In geometry, the process of changing one configuration into another, including slides, rotations and reflections.

Exponent Tells how many times a number or variable is used as a factor. For example, 6 with an exponent of 3 (6^3) indicates that 6 is a factor 3 times (6 x 6 x 6).

Exponential Function A function commonly used to study growth and decay. It has a form $y = a^x$.

Expression A mathematical phrase with no equal sign, such as $3x$, 6, $2n + 3m$.

Factors Any of two or more quantities that are multiplied together.

Finite Graph A structure consisting of vertices and edges, where the edges indicate a mapping among the vertices (e.g., the vertices may represent players in a tournament, and the edges indicate who plays whom).

Flip A transformation, also called a reflection, that produces a mirror image of a geometric figure.

Fractal An algebraically generated complex geometric shape having the property of being endlessly self-similar under magnification. Some computer screen savers utilize fractals.

Function A dependent relationship between two sets of numbers in which a value in the first set has only one defined element in the second set.

Identify To state, match, select, write.

Imaginary Numbers The square root of a negative number usually expressed using *i*, e.g., $(\sqrt{-9}) = 3i$.

Indirect Proof A deductive proof using contradiction or elimination to rule out all except the desired conclusion.

Inductive Reasoning A form of reasoning from individual cases to general ones or from observed instances to unobserved ones.

Inequalities Statements indicating that two quantities are not equal, utilizing symbols > (greater than) or < (less than) and $\neq$.

Integers A set of numbers consisting of the whole numbers and their opposites {. . . –2, -1, 0, 1, 2 . . .}.

Inverse A related but opposite process or number such as multiplication being the inverse of division and 2/1 being the inverse of 1/2.

Irrational Numbers A set of numbers that cannot be represented as an exact ratio of two integers. For example, the square root of 2.

Iterative Processes In discrete math, a method of calculating an amount by using an initial value and applying a function repeatedly.

Linear Function A function that has a constant rate of change and can be modeled by a straight line.

Logarithm An alternative notation for expressing an exponent.

Logic A system of reasoning used to validate arguments.

Magnitude Size or quantity.

Manipulatives A wide variety of physical materials and supplies that students use to foster the learning of abstract ideas in mathematics.

Matrices A rectangular array of numbers or letters arranged in rows and columns.

Mean In statistics, the average obtained by dividing the sum of two or more quantities by the number of these quantities.

Measures of Central Tendency Numbers that communicate the "center" or "middle" of a set of data. The mean, median and mode are statistical measures of central tendency.

Median In statistics, the quantity designating the middle value in a set of numbers.

Mode In statistics, the value that occurs most frequently in a given series of numbers.

Model (noun) A display of concrete materials, objects or drawings.

Model (verb) Use of concrete materials, symbolic.

Monomial In algebra, an expression consisting of a single term such as $5y$.

Multiple A number into which another number may be divided with no remainder.

Nonstandard Measurement Measurement expressed in terms of objects such as paper clips, sticks of gun, shoes, etc.

Normal Curve In statistics, the distribution of data along a bell-shaped curve that reaches its maximum height at the mean.

Open Sentence A statement that contains at least one unknown. For example, $6 + x = 14$.

Parallelism The state of being parallel, not intersecting.

Parameter A quantity whose value varies with the circumstances of its application, such as the radius of a group of circles.

Permutations Ordered arrangements of a given number of items in a set.

Polynomial In algebra, an expression consisting of two or more terms such as $x^2 - 2xy + y^2$.

Primes Counting numbers that can only be evenly divided by two numbers which are the number itself and 1. For example, the numbers 2, 3, 5, 7.

Proportion An equality between ratios. For example, $2/6 = 3/9$.

Quadratic Function A function that has an equation of the form $y = Ax^2 + Bx + C$ where A does not equal 0.

Radian The size of the central angle of a circle when the arc length equals the radius.

Random Variable A quantity that can take any one of a number of unpredicted values.

Range In statistics, the difference between the greatest and smallest values in a set of data.

Ratio A comparison expressed as indicated division. For example, there is a ratio of three boys to two girls in our class (3/2, 3:2).

Rational Numbers Numbers that can be expressed as an exact ratio of two integers.

Real Numbers All rational and irrational numbers.

Rectangular Array An organized arrangement of square units (tiles).

Recurrence Relations In discrete mathematics, a value in a series is derived by applying a formula to the previous value.

Recursive Sequence In discrete mathematics, a series of numbers in which values are derived by applying a formula to the previous value.

Reflection In geometry, a transformation, also called a flip, that produces a mirror image of a geometric figure.

Rotation In geometry, a transformation that turns a figure about a point.

Sample A part of the total population. Used in statistics to make predictions about the characteristics of the entire group.

Scatter Plots A graph of the points representing a collection of data.

Scientific Notation A shorthand way of writing very large or very small numbers. A number expressed in scientific notation is expressed as a decimal number between 1 and 10 multiplied by a power of 10.

Similarity In geometry, objects or figures that are the same shape but not necessarily the same size.

Sine A trigonometric function that is defined as the ratio of the leg opposite the angle to the hypotenuse of its right triangle.

Skip Counting Counting by equal intervals.

Slides In geometry, a transformation where a figure moves in a given direction.

Square Root Two equal factors of a number. For example, 4 is the square root of 16.

Standard Deviation A statistic that measures the dispersion of a sample.

Stem-and-Leaf Plot A table utilizing digit(s) of a number as stems and the other digit(s) as leaves. For example, 5 | 7, 8 shows 57 and 58.

Survey Interview, questionnaire and/or polling.

Symmetry A correspondence in size, form and arrangement of parts on opposite sides of a plane, line or point. For example, a figure that has line symmetry has two halves that coincide if folded along its line of symmetry.

Synthetic Representation The geometric form as opposed to the algebraic representation of a figure.

Tangent A trigonometric function of an angle which is defined as the ratio of the lengths of the leg opposite to the leg adjacent to an angle in its right triangle. Also a line having one point in common with a curve.

Tessellations A mosaic formed by repetitions of a single shape.

Theoretical (mathematical) Relating to the probability of a given event, using mathematical relationships (e.g., the chance of a red side coming up on the flip of a two-colored counter is one in two or 1/2).

Transformation A geometric process for changing one figure into another.

Trigonometric Ratios The ratios of the lengths of pairs of sides in a right triangle, i.e., sine, cosine and tangent.

Trigonometry The branch of mathematics involving triangles that combines arithmetic, algebra and geometry. Trigonometry is used in surveying, navigation and physics.

Validity An argument that is correctly inferred or deduced from a premise.

Variability Numbers that describe how spread out a set of data is (e.g., range and quartile).

Variable A place holder in algebraic expressions. In $3x + y = 23$, x and y are variables.

Vector Quantity that has magnitude (length) and direction. It may be represented as a directed line segment (→).

Whole Numbers The counting numbers and zero {0, 1, 2, 3 . . .}.